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NORTH AMERICAN AVIATION, INC. / LOS ANGELES DIVISION

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July 12, 1966

In reply refer to:
66LA-21578-205

National Aeronautics and Space Administration
George C. Marshall Space Flight Center
Huntsville, Alabama 35812

Attention: Mr. Paul H. Schuerer (R-ME-MMP)

Contract NAS8-20530, "Titanium S-IC Skin Section"

Following is the twelfth monthly progress report on subject contract. Activities and accomplishments during the period of June 1 through June 30, 1966 are covered.

Phase III Fabrication Progress

A special hand truck, or dolly, was completed and delivered to the assembly department for use in the layup and in-house transportation of the large Phase III packs. This dolly, equipped with casters stressed to support a load of 40,000 lbs., was designed to accommodate the production packs of both the Skin Section and Y-Ring roll diffusion bonding development programs.

Machining of the .066 titanium webs to the 4.490 \pm .002 height and 144.000 \pm .010 length dimensions was vended to the same supplier that machined the titanium cap strips, Central Tool and Engineering Company. The job was nearing completion at the end of June.

Physical rearrangement of the assembly department, involving dismantling and moving of heavy equipment and reinstallation of electric blanket units and power supplies, caused a delay in the duplex annealing of the .285 titanium plates from which the face sheets will be made.

In order to try to meet the scheduled date for delivery of the S-IC Skin Section to NASA/MSFC, a review of required fabrication effort was made preparatory to establishing a day-by-day plan of action and the manpower necessary to execute the plan.

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On June 27 the Project Manager, A. G. Jones, visited the Homestead Plant of U. S. Steel Corporation to discuss plans for the heating and rolling of Packs J. and K. During a tour of the shop, Mr. Jones was shown the furnaces, the handling and conveyor system, and the 160-inch plate rolling mill which will be used in the processing of the two full-scale packs. Practice runs have been made in which a steel plate has been transported from in front of the furnace to the conveyor rolls of the 160-inch mill in three minutes elapsed time. Mr. Lou Aquino of U. S. Steel stated that loss of temperature in this time will be negligible and will not affect the rolling of the packs.

Phase I Follow-on Progress

Fabrication of Pack H was stopped on June 14 at the request of NASA/MSFC. It was decided that completion of Pack H at this time would be too late to provide any contribution to Packs J and K. Therefore, activity on Pack H has been suspended until after Phase III has been completed. At that time a determination will be made concerning resumption of Pack H effort.

Layup and assembly of Pack G was completed on June 23, and the pack was shipped to Monroeville, Pennsylvania on June 24. Rolling of the pack was accomplished at the U. S. Steel Applied Research Laboratory on June 29 under the direction of George E. Kennedy. The programmed rolling to 60% reduction was completed in 15 passes, and the pack was subsequently air cooled. Temperature at the time of discharge from the furnace, after a $7\frac{1}{2}$ -hour heating and soaking period, was 1835°F.

Rolling data was being assimilated by Mr. Kennedy for forwarding to NAA/LAD. A more detailed account of the rolling will be presented in the next progress report. Features of Pack G which were not included in previous test packs are illustrated by the attached photographs. Enclosure 2 shows some of the titanium and steel details ready for pack layup. At the left are the three titanium cap strips, two of one-piece machined fabrication and the third a weldment with a drilled hole in the weld joint serving as a laboratory test control defect. The large plate is the titanium face sheet with a longitudinal weld joint. At the right is the titanium web with a transverse weld joint featuring a deliberate crack. The thicker plate and four strips in the center foreground are steel filler bars. All of the cold rolled

steel components of Pack G, plus the end frames of the yoke, were hot outgassed prior to assembly. In Enclosure 3 the details are shown as they were arranged in a stainless steel retort for the purging operation. The honeycomb material used for packing is PH15-7Mo CRES. The tube extending along the near side of the retort and feeding into the back is for back-filling with argon gas. Evacuation of the pack is through the purge tube at right center.

The closed retort is shown in Enclosure 4, and in Enclosure 5 the retort is within the insulation inside the electric blanket heating unit.

Yokes for the first six test packs were machined from solid billets of hot rolled steel. For Pack G, the yoke was patterned after the design of the full-size yokes for Packs J and K. Enclosure 6 shows the yoke prior to final assembly. The two central filler bars are drawn up by bolts to the end frames, with shims in place to maintain a gap. In layup, after the details were fitted into place, the shims were removed and the side bars cinched tight to assure complete pack density.

Program Review

On June 23 a slide-illustrated review of the program was presented as part of a familiarization program arranged by NAA/LAD for Mr. G. L. Campbell, Materials Laboratory, Wright-Patterson Air Force Base. Mr. Campbell expressed keen interest in the development of titanium roll diffusion bonding as a technique applicable to air-frame structure.

Activities in July

The next progress report will present an evaluation of the test results on Pack G, as well as more detailed data concerning the rolling operation. It is also expected that July activities will include the completion of the assembly of Packs J and K and the hot purging operations at American Bridge Division, U. S. Steel Corporation, City of Commerce, California.

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Cost and Schedule

The official report showing total expenditures and commitments through June 30 had not been released by the accounting department at the time this letter was written. However, the project manager's unofficial summary showed a total expenditure of approximately \$208,000.00. Projected expenditures by June 30, on the allocation curve, amounted to approximately \$247,000.00. The difference between the two totals reflects the behind-schedule position of the program, representing a time lag of six weeks in Phase III. The expenditures do include a major portion of the effort on Pack G. The contract price of Pack G is not included in the projected expenditures figure.

NORTH AMERICAN AVIATION, INC.



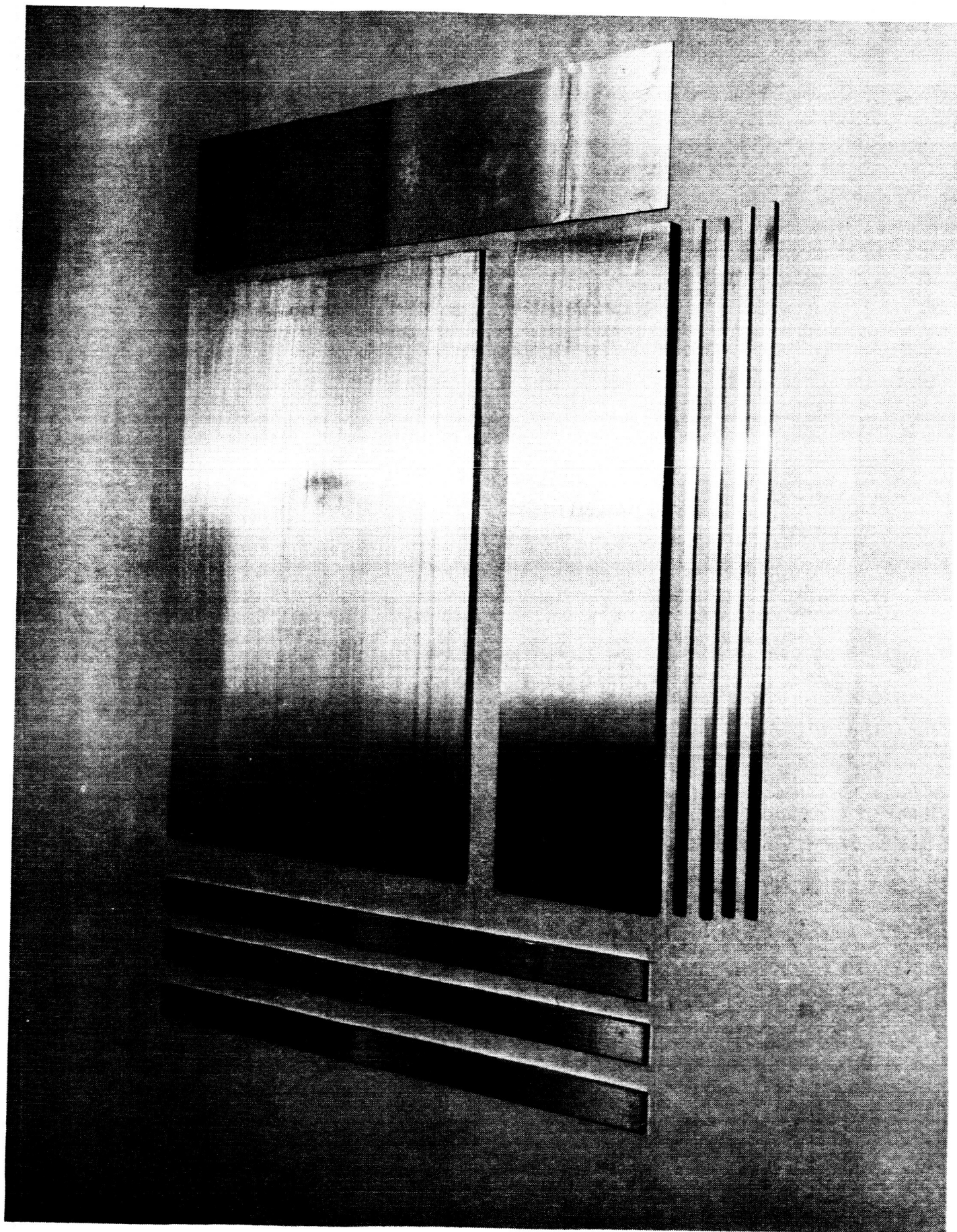
G. B. Lewis
Program Manager
Los Angeles Division

GBL/AGJ:jh

- Enc. (1) NAA Packing Sheet 66-47346
(2) NAA Photograph: "Pack G Detail Parts"
(3) NAA Photograph: "Preparing Steel Parts for Purging"
(4) NAA Photograph: "Steel Retort Sealed for Purging"
(5) NAA Photograph: "Hot Purging in Progress"
(6) NAA Photograph: "Pack G Yoke Construction"

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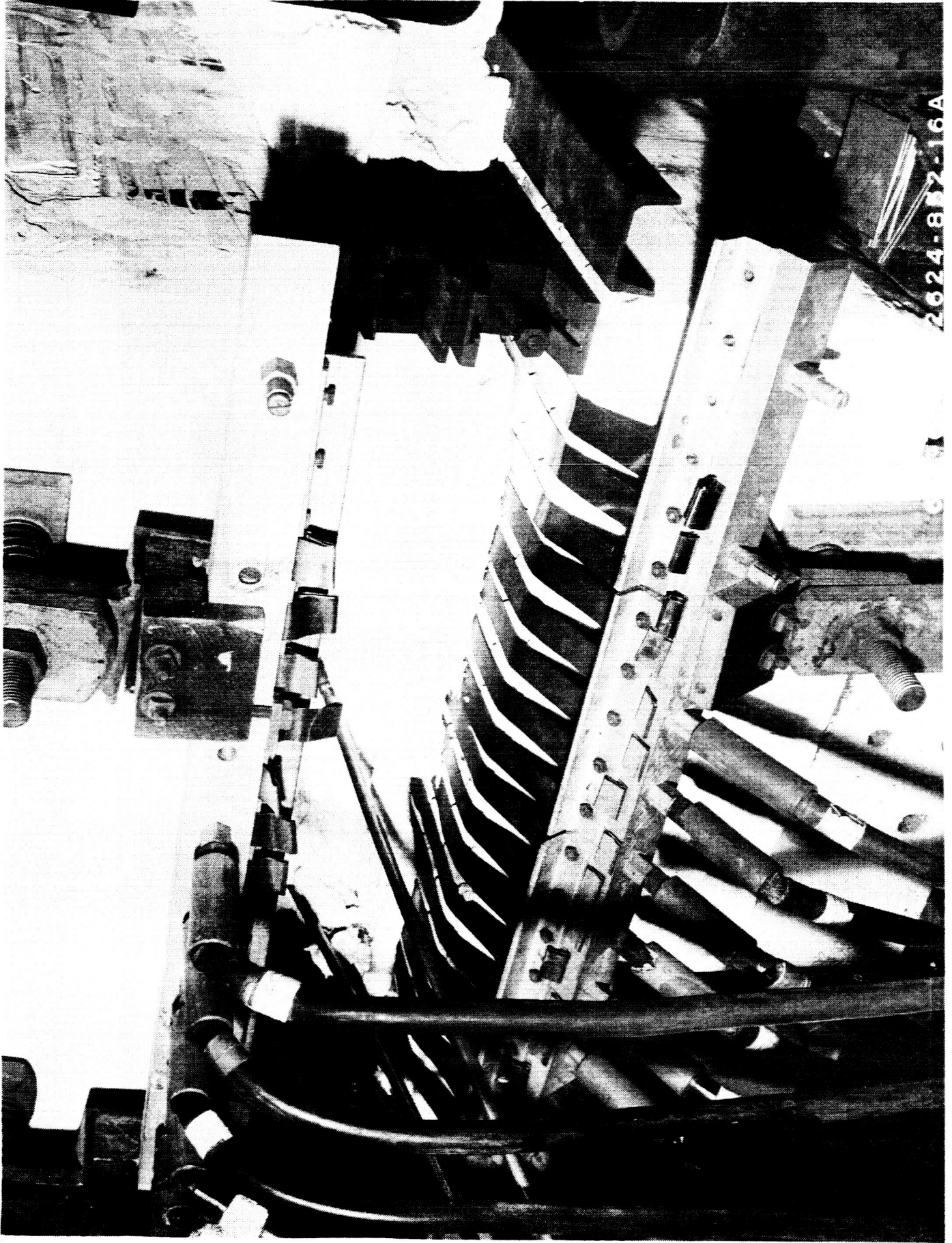
Enclosure 2 - "Pack G Detail Parts "



Enclosure 4 - "Steel Report Sealed for Purging"

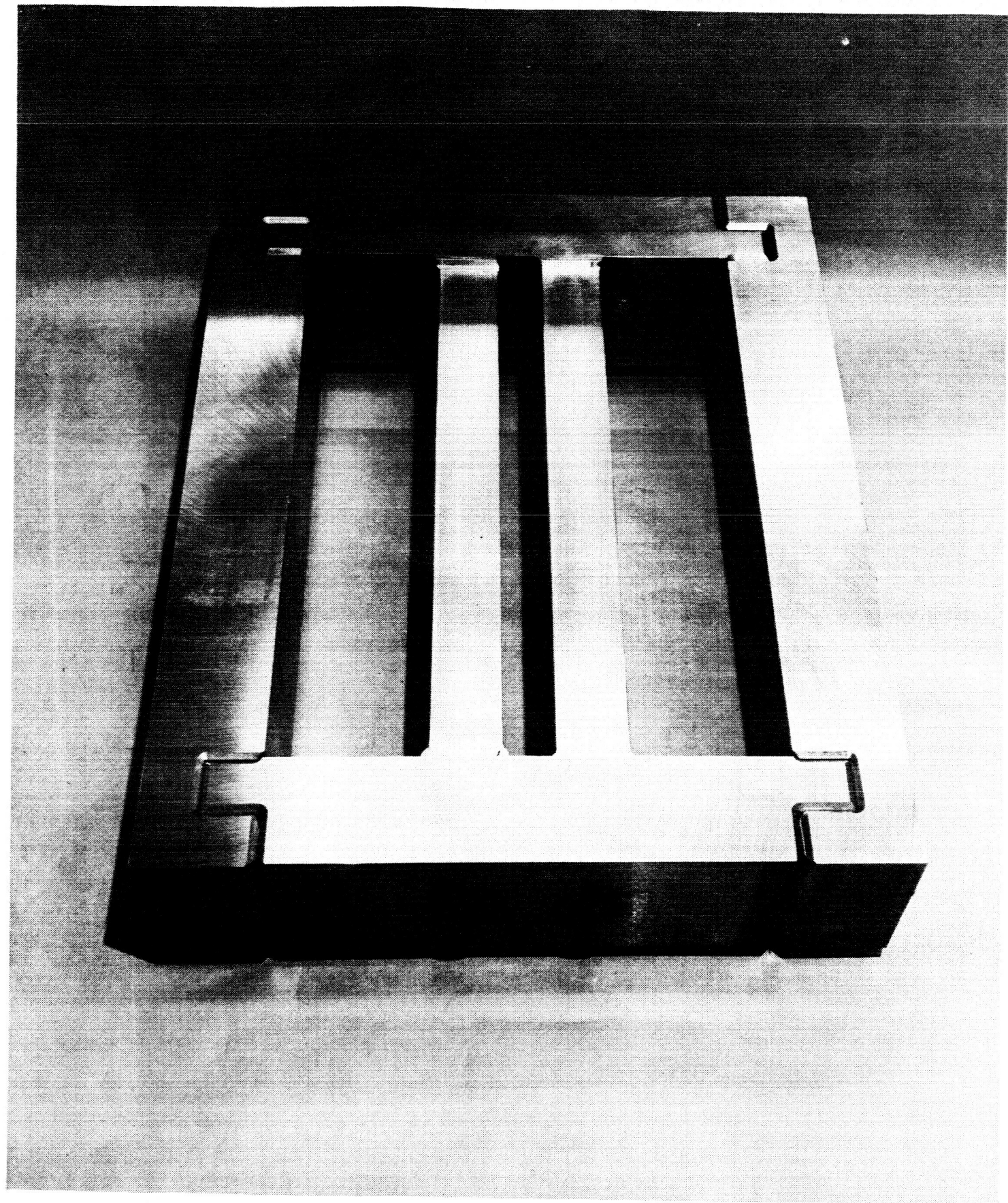


Enclosure 3 - "Preparing Steel Parts for Purging"



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Enclosure 5 - "Hot Piping in Process"



Enclosure 6 - "Pack G Yoke Construction"